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THE TECHNIC.

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IT affords us great pleasure to publish for our leading article, "Soap Bubbles," by Dr. Johonnott. This article is an extract from a lecture delivered by the Doctor before the American Physical Society at Chicago University on Saturday, April 22. Dr. Mees and Dr. Gray also belong to this Society, but were unable to attend. At the last meeting thirty-one papers were read on purely physical subjects, engineering entering very slightly, if at all, into the work. This Society numbers some of the best known physicists in the United States as members, Professor Carl Barus, of Brown University, Providence, R. I. being President.

THE leading article, "An Improved Motor Car," which appeared in the April number of THE ROSE TECHNIC was written by A. M. Hood, Rose '93. We sincerely regret the omission of the name of the contributor.

WITH the completion of this issue the Editorial Board of 1904–'05 surrenders its authority and turns over THE TECHNIC to a new Board. This course has been pursued by THE TECHNIC in order that the new Board may profit by the experience of the retiring Board in preparing its first issue. On Monday, May 1st, the following were elected for the ensuing year:

Carl Wischmeyer—Editor-in-Chief.
Clifford W. Post—Business Manager.
H. W. Wischmeyer—Assistant Editor.
Harry R. Canfield—Alumni Editor.
Harry W. Eastwood—Review Editor.
Fred W. Hatch—Athletic Editor.
Donald McDaniel—Exchange Editor.
Carl B. Andrews—Local Editor.
T. Ludwell Lee—Artist.

Carl Wischmeyer has served THE TECHNIC as Local and Assistant Editor, and so is well qualified for the position of Editor-in-Chief.

H. W. Wischmeyer, H. W. Eastwood, C. B. Andrews and C. W. Post have each had a year's experience on the staff. The others are new men to the work, but all come well recommended.

As we pass from are to have been, we wish, in passing, to thank our friends among the Faculty, Alumni and students for the help so willingly rendered by them during the past year. Work on a college paper is not always a pleasant nor an easy task, but our many friends have made it a most pleasant and profitable undertaking by their rational advice and more substantial con-

tributions, and with a continuance of their friendship, the path of the next Editor-in-Chief will be made much smoother. That he may have as many friends in time of need as his predecessor had is our most hearty wish.

Our Business Manager, Mr. H. W. Eastwood, deserves much praise for the efficient manner in which he has filled his office. By his alertness in business, and his ability in matters pertaining to such work, he has run the financial department of the journal with gain for THE TECHNIC and credit to himself.

THE 1905 catalogue has just come from the from the press, and the Alumni will probably be interested in looking it over, especially the list of their names, addresses and positions in the back. Some of the Alumni were a bit backward, however, in supplying the desired information for this catalogue, while others have changed their occupations even in the short time since it went to press. A list of these changes may prove of interest and enable those who desire to do so to correct the record up to date. These changes will be found under alumni notes.

THE May number of *The Electric Club Journal* contains an abstract from an address at the annual dinner of the Cornell University Alumni by Mr. Walter C. Kerr, President of the Westinghouse Church-Kerr Co., in which he expresses his views on some of the phases of modern educational tendencies. Mr. Kerr's address is put in a terse style and forms an interesting contribution to the subject of education, which is discussed so much at the present time.

SOAP BUBBLES.

By E. S. JOHONNOTT, Ph. D.

EVERYONE is doubtless familiar with the beautiful colors and symmetrical figures that it is possible to obtain with a soap film. Not everyone, however, appreciates what an important role the soap film has played in a purely scientific way. For example, a great many geometrical figures may be very accurately represented by soap films. But it is in the study of light that the soap film has played the most important part. In fact, it may be said to have been the origin of all the work on interference of light. Maxwell, the eminent mathematical physicist, has said, that "one might spend his life in the study of the soap bubble and still learn beautiful lessons in physical science."

A pathetic instance where one spent his life in this pursuit is that of Plateau. He lost his sight early in life and was forced to depend on the observations of others.

Plateau was the first to suggest that the thickness of the thinnest liquid film obtainable, might be a measure of the diameter of the sphere of molecular attraction. It might be of interest to explain briefly his reasons for this belief.

One of the fundamental principles, if not the fundamental principle, of the constitution of matter is that law which explains the mutual attractions or repulsions that exist between the molecules. It is quite certain that this cannot be the law of gravitation, i. e., the inverse square of the distance. All theories agree that the law is such that the force acting between two molecules is insensible only when the distance between the molecules is insensible and becomes evanescent when this distance becomes sensible. That distance beyond which the molecular force becomes insensible has been called the "Radius of the Sphere of Molecular Attraction." It is evident that its magnitude depends on the sensitiveness of the method of its determination.

Now there is no method of observing the action of the molecular forces, that compares, in directness, with the phenomena exhibited by thin liquid films.

The explanation of the phenomena of capillarity is that the resultant attraction on a molecule, situated deep in the liquid, is zero. If now this molecule should come sufficiently near the surface so that its sphere of attraction extends beyond the surface, then the forces will become unbalanced and resultant force on the molecule will be inward towards the liquid and normal to the surface. If now we consider a film thinner than the diameter of the sphere of attraction, it is not difficult to see that the resultant pressure on the surface due to attractions on all of the molecules near the surface would become smaller as the film becomer thinner.

The elementary theory of capillarity demonstrates that this is equivalent to saying that the tension in the surface diminishes.

It is interesting to consider the great magnitude of this resultant pressure per unit area on a plane liquid surface. Several independent methods place it between 10,000 and 25,000 atmospheres, or something greater than 150,000 pounds per square inch. Hence the expression, "as weak as water" loses its force, since this pressure must be balanced by what is called "intrinsic pressure" of the liquid.

In view of the above consideration Plateau's argument becomes clear, viz: that as soon as the thickness of the film falls below the diameter of the sphere of attraction, the tension will diminish and the film break.

Plateau concluded, from his observations, that the the tension begins to fall in a film when it reaches a thickness of 120 micromillimeters. A micromillimeter is one millionth of a millimeter, or about one twenty-five millionth of an inch. A film having this thickness is about the thinnest film which shows color due to the interference in the reflected light. It is possible to obtain films where the thickness is much less, in fact so much

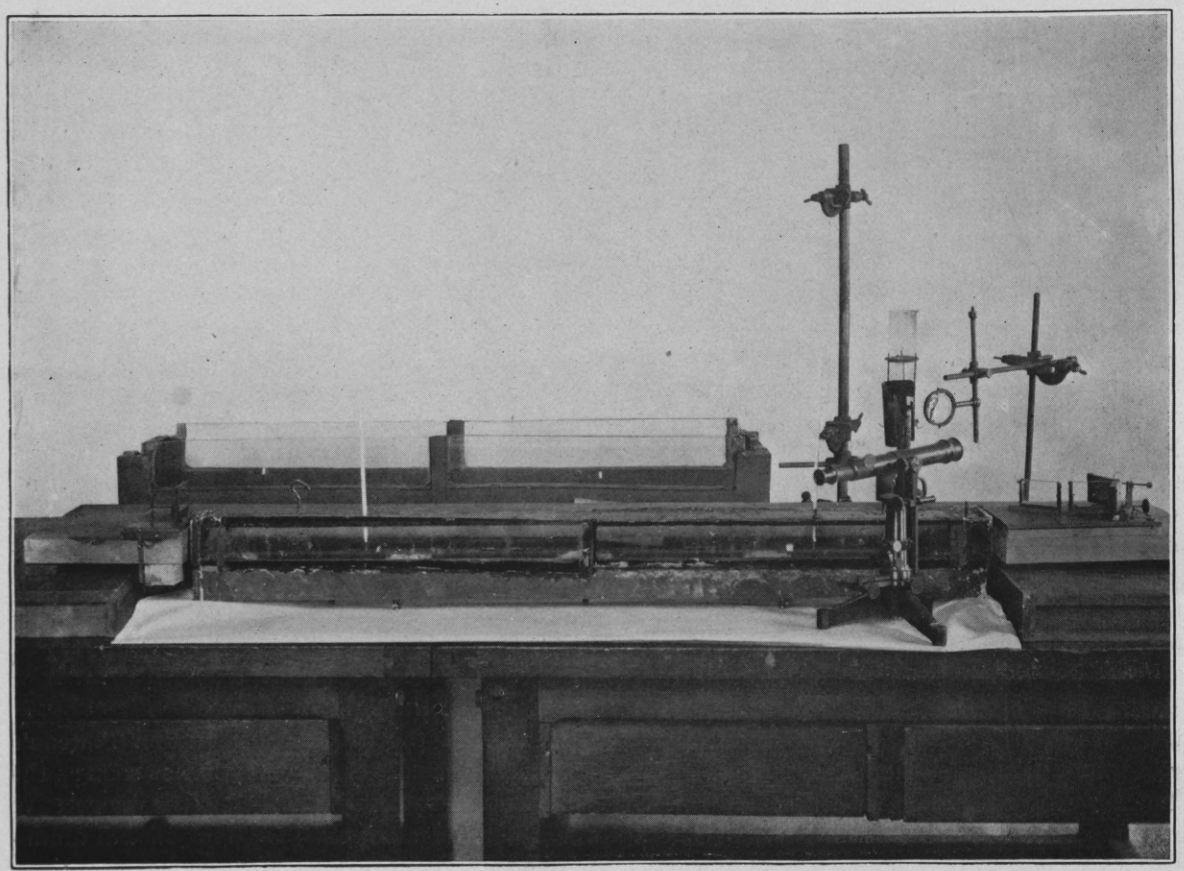
less that they are apparently black. Newton was the first to record observations on these black films. He even distinguished two distinct shades in the black spot, one even darker than the other.

He found the first black to begin with a thickness of 36 micromillimeters, which accords closely with the latest determinations

Reinold and Rücker, two Englishmen, have published descriptions of experimental work on the subject, extending over a period of sixteen years.* They conclude that the thickness of the black spot is constant at a value of about 12 micromillimeters, thus making the radius of the sphere of attraction about six such units.

P. Drude obtained a value of 17 micromillimeters. The writer using Prof. Michelson's interferometer, which is exquisitely well adapted for measurements of this character, not only made measurements on the thickness of the first black, but the second black as well.

It was found that the first black varied in thickness between limits of 40 and 12 micromillimeters. The second black had apparently a constant thickness of 6 micromillimeters. It was necessary to use as many as 50 films to give sufficient displacement of the fringes of light.



The first black film was found to vary in thickness with the temperature and the hygrometric condition of the atmosphere of the film.

Somewhat concordant results were obtained with a second method depending on the principle of the intensity of the light reflected from the surface of the film. This work was published in the London Philosophical Magazine in June, 1899.

More recently it was discovered that great

* Phil. Trans. Roy. Soc., London, 1877 to 1893.

changes in the characteristics of the black films could be produced by varying the pressure on the atmosphere surrounding the films. For instance, a sudden increase in this pressure was found to produce a rapid thinning, while a sudden diminution in the pressure produced a correspondingly rapid augmentation in the thickness.

On subjecting the first black film to a sudden increase in pressure it was found possible to convert it suddenly into a second black. If this were followed by a sudden diminution in pressure the film became reconverted into a first black and possibly into a film sufficiently thick to show the yellow of the first order.

The evident explanation of these effects is that the heating due to adiabatic compression produces a higher saturated vapor pressure and evaporation from the surface of the film, while the cooling due to adiabatic expansion is accompanied by a lowering of the vapor pressure and condensation on the surface of the film. This condensation is often noticed in the bell-jar of an air-pump if the exhaustion is quite sudden and the atmosphere damp. In this case the condensation takes place on the dust particles present. After a few repetitions the air is rendered dust free and the phenomenon ceases. However, the presence of dust, doubtless, has little effect on the condensation on the film, since condensation takes place more readily on a plane surface than on a convex surface.

These observations on the effect of pressure led to a repetition of the previous measurements of the thickness, in which a greater number of films, 221, was used. A form of the interferometer was used that made it possible to get the pressure effects.

It was found possible to produce extreme variations in the thickness of the films in the course of a minute or two instead of several hours.

The apparatus used is shown in the cut, and was kindly loaned by the University of Chicago. It consists, essentially, of several accurately ground pieces of plane parallel glass plates. These are arranged so that the light is split into two parts traversing different paths. Into one of these paths the films are interposed. The light which passes through the films suffers retardation, and it is this retardation which is measured by the displacement of the fringe, that determines the thickness. For 221 second black films this retardation is about 1.5 fringes.

The results obtained, for the first black film, confirmed those of the earlier work. In the case of the second black, however, it was found, in many instances, to begin with a value as high as 9 micromillimeters, falling quickly to a mean value of 6.

No further reduction in this value could be produced by sudden increase in the pressure even when accompanied by a sudden rise in temperature. It might be remarked that formerly the second black was produced by heating the first black, or exposing it to a drier atmosphere. This evidently produces evaporation from the film, thus thinning it.

Possibly the most striking feature of the phenomena of the black spots is the discontinuity in thickness at the junction of the black and the color films and also at the junction between the the two blacks.

Reinold and Rücker have observed black films in equilibrium with colored films 250 times as thick. An explanation of this phenomenon has been advanced by Lord Kelvin. He imagines the molecular forces to be alternately attraction and repulsion. The question arises at once, how can the film exist as a liquid if the molecular forces are repulsion? Laplace's theory of capillarity, however, shows that this is the interpretation to be placed on the fact, that to the discontinuity in thickness at the borders of the black film there corresponds no discontinuity in the tension.

Viewing the films with a microscope it is possible to distinguish as many as five black films. These break one into another in precisely the same manner that the black film is ordinarily formed, each successive film being apparently thinner. The first three formed are, however, quite evanescent and seldom extend over an elevation greater than two or three millimeters. The last

two are identical with what has been termed the first and second black films.

Of course, this would infer that there are five alternations in the molecular repulsion and attraction.

In any case, so little is known concerning the causes and meaning of these black films that we can do little more than speculate.

We need no better incentive, however, to pursue work of this character than the possibility that it may assist in fulfilling a prophesy made long ago by Maxwell. He says, "the surface which forms the boundary between a liquid and its vapor is seat of the phenomena, on the careful study of which depends much of our future progress in the knowledge of the constitution of matter."

Factory Fire Protection and Water Supply.

By A. EUGENE MICHEL, '03.

IN manufacturing plants, fire protection is imperative, since the destruction of buildings and their contents means the breaking up of general system and routine work, and opens the field of established trade to competitors during the period of reconstruction, inflicting losses which cannot be insured against, and which, in the majority of cases, necessitate practically the discontinuance or re-establishment of the business. The most disastrous fire that ever occurred could probably have been smothered at one time by a pail of water, and the recent conflagrations in Baltimore, Toronto and other cities have demonstrated that the fire pump, tank and sprinkler systems not only give protection from interior fires, but act as effective barriers to general conflagrations in thickly settled districts. The permanently lessened cost of insurance following the introduction of private fire protection, or better, prevention, is in itself a considerable item. A reduction of rate of as much as 40 per cent. is frequently made upon risks where sprinklers are installed, with watchmen and watchmen's clocks.

An example of the most modern practice is afforded by the new Henry R. Worthington Hydraulic Works at Harrison, N. J. This plant covers 34 acres of ground and contains 18 acres of floor space and accommodations for 5,000 men. The buildings of the plant are of brick and fireproof construction, with the exception of the pattern shop, which is of the "slow-burning type. The plant is furnished with a complete pipe line system, the sprinkler and hydrant connections, and the locations of the wells, reservoir, elevated tank, pumps and air compressors, and is connected with the city main. These mains vary from 8 ins. to 12 ins. in diameter and have been tested to 200 lbs. pressure, form loops around all the buildings and feed the interior piping at many points. Gate valves at different points in the mains make it possible to shut the water off from any part for repairs or other purposes without interfering with the protection of any building. Twenty-seven fire hydrants, with two or three openings each, are strategically distributed about the plant.

In the interiors of the buildings, hose reels and hand grenades are conveniently distributed, and the Grinnell system of overhead sprinklers with glass valve seats is installed with one sprinkler to every 20 sq. ft. of roof and ceiling. These valves open as soon as a temperature of 200° F. is reached and distribute a strong horizontal spray in all directions, The discharge orifice is half-

inch in diameter. Half-inch nozzles and quick-opening gate valves are used on the hose lines, which are 2 ins. in diameter. Pressure gauges and automatic check valves are placed in the supply pipes or "risers" of the sprinkler system, and if the outside mains are broken on one side of a building, the check valves hold the water in the sprinkler system, which will still be supplied through the other connections to the mains. In addition, gate valves with indicator posts are placed in each connection from the mains to the risers.

In a system of protection, the water supply is an important factor. Indeed, the question of economical water supply for fire protection, the boiler plant and other uses, together with advantageous manufacturing and shipping facilities, settles the location of most extensive plants. A supply from the city mains may be altogether inadequate in the time of need, and is in any case a source of constant expense. Before determining on the site, test wells were sunk which penetrated strata of disintegrated brown stone with a good supply of water at a depth of about 200 ft. An interesting fact is that the water is at first muddy, but soon becomes clear, at the same time increasing in quantity due to the washing out of crevices in the rock. Deep wells furnish an ideal supply in densely populated districts, as they have none of the disadvantages and dangers of exposed streams and reservoirs. The four wells of the Worthington plant pass through loam, sand and hard pan before entering a bed of gravel and have an average depth of about 400 feet.

Water is raised by the air lift, which is peculiarly well adapted to scattered batteries of bored or drilled wells. It permits centralization of the power plant, as the air compressor may be located at any convenient point and the air piped to the wells. It also eliminates all valves, plungers, and other moving parts from the well itself, thus doing away with the wear arising in other devices from sand and gravel. Compressed air is forced into the water through a nozzle inside and near the bottom of the flow pipe, forming a column of mixed water and and air of low specific gravity within the latter, which, under the pressure of the solid column of water in the well outside, rises continuously. The submerged parts of the pumping outfit consist simply of the wrought iron casing, flow and air pipes, a strainer, an elbow and pipe connections, all of which are practically indestructible, even when working in the gritty water so fatal to deep-well pump pistons. At the Worthington plant there are four of these wells averaging 400 ft. in depth scattered within a 200 ft. radius, and having 8-inch casings, 5 ⅝-inch air and 4 ¾-inch flow pipes. One well discharges a mixture of air and water directly into the concrete basin or reservoir nearby. In the others the air and water discharge vertically from the flow pipe against an "umbrella," which allows the air to escape while diverting the water back into an open concrete basin from which it flows by gravity into the reservoir.

Air is supplied to the wells at a pressure of from 80 to 85 lbs. by a Laidlaw-Dunn-Gordon compressor in the main power house, having a capacity of about 800 cu. ft. of compressed air per minute. Ninety lbs. pressure is required to start the wells, but 60 lbs. will maintain the flow. When it is desirable to pump an unusual quantity of water, or stop this compressor, a larger Cincinnati-gear compressor by the same builders, which furnishes air for the foundry, machine shop, and other departments may be employed.

The wells discharge into a 500,000-gallon reservoir. It is of solid concrete four inches thick, on a clay foundation, and in shape resembles the frustum of an inverted pyramid, being 121 ft. long, 104 ft. wide, and 9 ft. deep in the center. At the right of the reservoir are three receiving basins, the first of which receives the discharge from the wells and overflows into the main reservoir. The middle basin is connected by a large screened passage to the main reservoir, and from it the Underwriter fire pumps take their supply. The third small basin acts as an overflow for the main reservoir, and

also supplies the water used by the pumps of the Hydraulic Elevator System, from which the water returns by gravity to this same basin. The basin overflows to the sewer.

From the reservoir, water can be raised to a 100,000-gallon steel tank on a steel tower, by either of two Worthington Underwriter pumps of 1500 gallons capacity each. The tower is 135 ft. high and the tank 15 ft. deep, so that, as the tank is always kept filled, there is constantly on the service mains a head of 150 ft. creating a pressure of 65 lbs. per sq. in. throughout the system. The stand pipe leading to the elevated tank connects with the main fire line system through a check valve and by-pass at the point where the discharge from the pumps enters the system. Ordinarily, the by-pass is left open and the pumps are controlled by an automatic pressure regulator to maintain a pressure equal to that due to the head in a full tank. In this way the pumps supply the water for daily consumption just as it is needed.

In case of fire, the water from both the tank and the pumps is available, but if a higher pressure should be wanted, the by-pass may be closed and, if the capacity of the pumps is sufficient for the needs of the occasion, the check-valve will also close, and a pressure of 150 lbs. per sq. in. can be maintained by adjusting the regulating valves of the two Underwriter pumps. If the pumps do not supply water as fast as it is used, the check-valve at the base of the water tower will allow water to flow into the mains from the tank. Since the pumps have a combined capacity of 3,000 gallons per minute, if both are operating to their full capacity, night and day, it will take 6.06 hours to empty the reservoir, after which 1,350 gallons per minute can still be obtained from the wells. Should either of the Underwriter pumps fail, the house pump and the hydraulic elevator pump may be turned into the system, thus making complete stoppage of the fire system practically impossible. Yet should such occur, there remains a connection through a water meter to the city mains which may be utilized to obtain 90 lbs. pressure indefinitely.

The Class News Letter.

FOUR years of daily association in class-room and on campus will almost certainly develop friendships of life-long standing. Especially is this true of a college such as Rose, where the relation of the members of any class is very intimate. Class spirit of the genuine sort is strong and tends to continue beyond the limit of commencement. Many a man comes to that eventful June day when he must say farewell to the majority of his classmates forever, with a feeling that something should be done to keep the boys in touch as a class. Personal correspondence is sure to follow between those more intimate, but will not by any means fill the desire for news from the class as a whole. Some form of circulating letter seems to be the natural means to this end.

The "round robin" is a time-honored institution and has the merit of simplicity. The usual method for starting this is to select one of the members of the class as secretary, who makes out a route for the letter and mails this with his own letter to the class, to the second man on the list. He in turn adds a letter, checks his name, and sends it on. So it goes on, the bunch of letters growing until in time it returns to the first man, who removes his first letter, adds a new one, makes some changes, perhaps, in the route, and starts the whole on the round again.

The work of circulating the letter and the responsibility are thus divided up so that it cannot become burdensome to anyone. Some other features are also good. The letters are in the genuine "fist" of each writer and carry the interest always attached to an autograph letter. Sketches and photographs can be included or attached to

the letter, and there is opportunity for much originality in the make-up. There being no set time for the arrival of the bunch of letters, its receipt will always bring the pleasure of the unexpected.

On the other hand, the indifference of one or two members of the class may seriously delay the letter or bring it to a stop altogether. At least the older letters of the bunch will always be somewhat stale. In case of a delay of several months somewhere along the line, this will be true of them all when resurrected. The conscientious member feels that he should take but a limited time to enjoy the letters, and he has no chance of filing them for future reference, both of which may be considered as objections.

There is a plan for a class news letter which has, we believe, been tried by several Rose classes and in the case of the class of '96 with continued success ever since graduation. This concentrates the responsibility for the letter in one man, who acts as editor and circulation manager. Once a year he mails postal card notices to all class members asking for a letter by return mail, with enclosure of a small remittance to cover postage and other expenses. Delinquents are hunted down with second postal cards, and finally personal letters. The resulting letters are arranged alphabetically and mimeographed. A copy of the whole is then mailed to each person contributing. The careless or busy member can thus only delay the issue to the extent of the time taken by the editor in trying to round him in. In fact, the knowledge that he may lose out on the whole bunch unless he gets his address, at least, in to the editor, is an effective spur to the fellow with the least spark of class spirit. The letters are all fresh and bring each member up-to-date with the location and progress of the others.

Each issue of the Class News Letter of '96 is usually followed by an exchange of many personal letters, prompted by the information and suggestions contained in its pages. The writer has kept a file of the nine issues to the present time, and has spent many a pleasant hour looking back down the years by their help, and reading selections to friends. One copy of the issue for 1899, mailed on Dec. 1st, reached Wallis R. Sanborn in the mountains of the Klonkike country, sixty miles from Dawson City, the following April. In the next issue he comes up with a rousing letter, as full of enthusiasm for the news letters as it is of the incidents of his stay in that wild corner of the great domain. He says "You can just bet I read that letter with interest, and I can't say how many times, either." Some of the other fellows have covered much country in their business experience, and have seen other things beside engines and generators. Burk spent a summer in the mountains of California, and tells about life in a cabin. Wells wandered all over New England installing generators and transformers for the Wagner Elec. Mfg. Co. Decker has been fortunate in witnessing some notable public events in and around New York City, and gives some graphic accounts of them. Walser turns up in a different gulch of the Rocky Mountains in almost every letter, being now in Walkerville, Mont., a suburb of "Butte, the Wicked," which he says is not so bad when you get used to it. A pleasant feature of the last number was a letter from Prof. Hathaway, sending greetings from Rose and reminding us of the hours in the class room next to the President's sanctum.

The number of members responding to the editor's call has varied from fifteen to twenty-one. This from a class of twenty-seven at graduation. Seventeen were represented in the last issue, Feb. 1905, with the total membership reduced by the grim reaper to twenty-five. Checking up from the back numbers we find that only seven bachelors have escaped the fair charmers. A census of the second generation of the class foots up to twenty, so that the prospects are good for '96 having a goodly show when the boys of the boys begin to enter the halls of Old Rose.

Some suggestions have been made as to the publishing of an Alumni annual, in which all classes might be represented by personal letters from members. This may come in time, and would fill a broader place than any effort by a

single class. Meanwhile, and preparing the way for such an annual perhaps, the news letters of the classes will continue on their rounds. As the editor of several numbers of the News Letter of '96, the writer will be glad to furnish information to other classes who may be interested in the plan, and can furnish a few sample copies of the last issue, if desired.

O. E. McMEANS.

Indianapolis, May 3, 1905.

ALUMNI NOTES.

He Gives Twice Who Gives Quickly.

In order to prosecute with greater vigor, and afford broader opportunity for complete success in the securement of the increase the Alumni Association has obligated itself to make for the Rose Endowment Fund, it has been deemed advisable to augment the present committee of three by including one member from each class graduated.

In conjunction with President Mees a meeting was held at the Claypool, in Indianapolis, on the 7th of April, at which time a complete class representation on the committee was accomplished by the nomination of eighteen new members, making the total membership as follows:

Class.	Name.	Residence.
1885	S. S. Early,	North Easton, Mass.
1886	H. G. Brownell,	Louisville, Ky.
1887	J. B. Aikman,	Terre Haute, Ind.
1888	Julian Scholl,	New York City.
1889	V. K. Hendricks,	Baltimore, Md.
1890	T. L. Condon,	Chicago, Ill.
1891	W. H. Boehm,	New York Cty.
1892	S. B. Tinsley,	Louisville, Ky.
1893	A. M. Hood,	Indianapolis.
1894	C. E. Mendenhall,	Madison, Wis.
1895	A. L. Robinson,	Princeton, Ind.
1896	O. E. McMeans,	Indianapolis.
1897	T. L. Camp,	New York City.
1898	J. M. Lansden, Jr,	Birmingham, Ala.
1899	C. A. Howell,	St. Louis, Mo.
1900	W. H. Insley,	Indianapolis.
1901	R. N. Miller,	Cambridge, Mass.
1902	F. R. Fisback,	Cleveland, Ohio
1903	Graham Davies	Chicago, Ill.
1904	Wm. C. Noelke,	Indianapolis.

From now until the close of the academic year on the 8th of June those alumni who have not responded to earlier calls will have an urgent communication from their respective class representatives, and it is to be hoped that not one will fail to sign the little pledge blank, with which all must be already more or less familiar. He may subscribe but one dollar a year, if more would be a burden, and he may date his first payment next November 1st, or even November 1st, 1906; any way, so long as he does it.

This will be the last general appeal to the Alumni for funds (future members of the Association will not be overlooked, however), as the work will be carried to new and larger fields as soon as commencement is over.

All communications for the Ways and Means Committee should be addressed to E. F. Folsom, Chairman, 445 Newton Claypool Bldg., Indianapolis.

Mr. A. C. Eastwood, '98, of the Electric Controller and Supply Co., Cleveland, Ohio, was in town recently to consult with Dr. Gray.

Mr. Max J. Hammel, '01, has recently entered the lists of the benedicts. The bride was Miss Rose Herz, daughter of the head of the firm with which Mr. Hammel is connected.

CHANGES IN NEW CATALOGUE.

Cohn, Clarence A., '04, with Utah Light and Railway Co., Salt Lake City, Utah. Residence, 670 E. Brigham St., Salt Lake City, Utah.

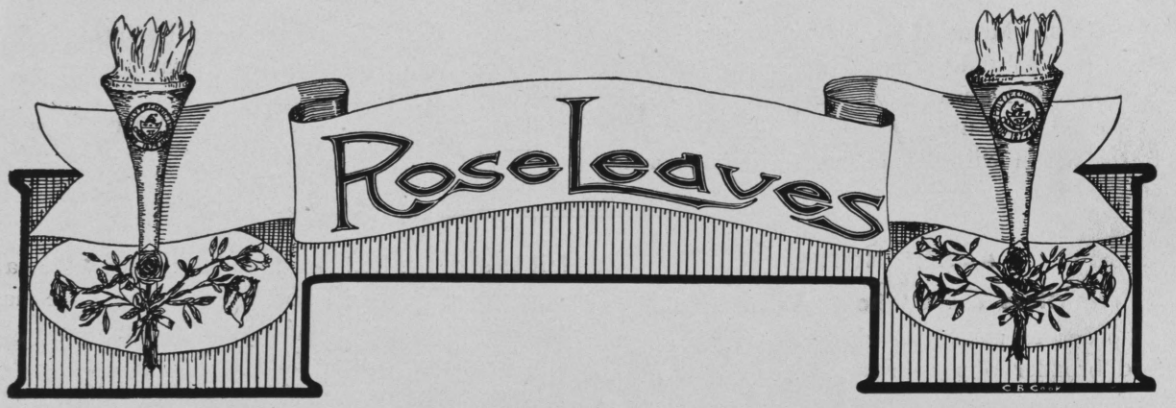
Blair, M. W., '03, first Asst. Mechanical Engineer, Illinois Brick Co., 914 Chamber of Commerce Building, Chicago, Ill.

Cox, N. Hadley, '03, with General Electric Co., Schenectady, N.Y.

Freudenreich, Wm. F., '98, (instead of '99).

Mering, Barclay G., '87, Manager Elevator Dept., Barnard & Leas Mfg. Co., Moline, Ill.

Whitten, Roscoe, '04, with the Atlas Engine Works, Indianapolis, Ind.



Corliss Engine Shop Practice.

By FRANK DELLE, '06.

SINCE the Corliss engine is in general use as a source of steam power, and is met with on every hand, a brief description of some of the methods used in shop practice in manufacturing the horizontal type of this engine will perhaps be of interest to the engineering student.

In this article it is not proposed to enter into a description of the methods used to produce the numerous small details, but to consider those methods which are used in turning out the larger parts, such as the cylinder, frame, fly-wheel, etc.

The cylinder will be the first taken in order.

After the cylinder casting is lifted out of the sand in the foundry and inspected for defects, such as unequal shrinkage, sand holes, misplacement of cores, etc., it is chipped, sent to the machine shop and placed on a boring mill. This mill bores out the cylinder and two of the valve seats simultaneously. When this part of the work is completed, the boring bars are set to bore out the cylinder counter bore and the two remaining valve seats. The ends of the cylinder and valve seats are next faced up to receive the cylinder heads and valve seat bonnets.

The partially finished casting is now taken to a horizontal drilling machine, which drills and partially taps all the holes for stud bolts and cap screws, by means of which the heads and bonnets are attached, it being necessary to retap all these holes before stud bolts can be turned in. This is done by hand.

The cylinder is now taken to the testing department and tested for leaks due to sand holes. Extra heads and bonnets are bolted on and steam at boiler pressure admitted through the indicator connections. As a rule, any leak which may appear can be easily stopped by caulking.

When the leaks, if any, are stopped, insulating material is mixed with water to the consistency of thick paste and applied to the exterior surface, the steam being left turned on in the meantime until this substance is thoroughly dried, after which it is turned off and the heads and bonnets removed.

The ports are cored out, and for this reason the sides are irregular. As the steam should be admitted, cut off, or exhausted, as the case may be, throughout the entire length of the ports at the same time, it is necessary that the edges of the valves be exactly in line with one of the sides of each of the ports over which they travel in performing their different functions.

In order to straighten the sides of the ports, a straight-edge is placed in the valve seat, a line scribed along the edge of the port, and the excess metal removed by chipping and filing.

Before being covered with a metallic jacket and sent to the erecting department, the cylinder is given a thorough cleaning out by means of

compressed air. It is important that this be well done and that no chips, sand or other foreign matter be left inside, for, when the engine is put in operation, the valves, valve seats and cylinder wall will be badly damaged, if not ruined.

The frames for the larger sizes of heavy duty engines are built up of two parts: a barrel containing the crosshead guides, and a heavy casting or housing which supports the main bearing for the crank shaft.

In machining the guide barrel, the guides are bored and the ends faced during a single setting of the machine. This insures that the center line of the guides will be at right angles to the ends. There is not much machine work required on the remaining part of the frame.

It is customary to cast the smaller sized flywheels solid and to machine them in a vertical boring mill. These mills are so arranged that several cuts can be taken at the same time. Thus one tool may be set to bore out the hub, while another is at work on the rim. It is thus possible to turn out a large piece of work in a short time.

In order to facilitate the handling and loading for shipment of wheels of large size, it is customary to cast them so that they may easily be separated into two parts. To accomplish this, cores are placed in the mold in such a manner as to split the hub and to leave a thin web of metal at two diametrically opposite parts of the rim.

Since it is impossible to swing a flywheel having a large diameter in the ordinary shop lathe or boring mill, a pit lathe, so called from the fact that a deep pit extends beneath the face plate, is used for this purpose.

Before placing a flywheel on a mandrel in the pit lathe, the hub is bored out to the required size by a portable boring mill, which is attached to the spokes and operated by either rope or electrical drive.

After the completion of this job, the machine is removed and the wheel broken into two parts, which are bolted together on the mandrel and attached to the face plate of the pit lathe.

Fitting the steam and exhaust valves is a job in which only the better class of machinists is employed, for this kind of work must be accurate. The valves are turned to a size making a rather close fit in the valve seats, and after leaving the lathe any tool marks or inequalities which may exist in the suface are removed by a smooth file, after which they are given a coating of oil and plumbago, placed in the valve seats and rotated by hand.

As the plumbago on the high spots is removed by this process, they are easily detected and filed down. This process is repeated until the valves have an even bearing and can be easily turned by hand.

When the different pieces have been finished and sent to the erecting department, the engine is assembled and lined up. The first thing done is to level the cylinder by driving wooden wedges under it. The front head, which contains the piston-rod stuffing box, is next provided with a gasket and fitted to the cylinder. The guide barrel is now attached and the whole thing tightened up. The remaining part of the frame is not bolted on until it is known that the guide barrel is in line with the cylinder.

To determine this, a fine line is tightly drawn through and accurately centered in the cylinder. The distance from the line to the guides is calipered, and if it should happen that the center line of the barrel does not coincide with that of the cylinder, the shortest distance from the guides to the line is found and the calipers are placed in a position diametrically opposite the first position, and a sufficient number of slips of paper are placed between the guide and the calipers to again bring them in contact with the line. The number of slips of paper are counted and by calculation the depth and position of the heaviest cut which must be taken from the front head in order to bring the guide barrel in line is determined.

The remaining part of the frame is now bolted to the barrel and lined up with the rest of the engine.

After the crank shaft, connecting-rod and piston are connected up, the stroke of the engine is

taken in order to determine if the clearance spaces are equal. This is done by placing the crank on the dead centers and measuring the distance from the end of the cylinder face to the piston in each position. As the length of the cylinder bore is known, the clearance in each end of the cylinder can be calculated.

The engine frame is now ready to receive a coat of thick paint, which fills the rough and uneven places in the casting. This is rubbed down with emery cloth and another coat applied. The final painting and decorating is not done until after the engine is sold and erected.

On Saturday evening, May 6th, the Class of 1905 attended the Grand in a body. The play was "Higgledy Piggledy and A College Widower" played by Joseph M. Weber's all-star company. The class occupied the first eight rows in the middle section. After the play the class met at the Terre Haute House for a farewell banquet. As this was the last time the Seniors would have the opportunity of appearing around the festive board as a class they each made the most of the occasion.

With H. E. Shryer acting as toastmaster, the following toasts were given.

"The Chorus"—E. H. Spalding.
The Stars—Geo. Benson.
The Audience (us)—W. S. Hanley.
The Rest—W. R. Heick.
Future of '05—R. C. Blanchard.
Our Last Banquet—H. L. Watson.

MENU.

Olives. Radishes.
Planked Florida Shad.
Cucumbers.
Roast Squab, Stuffed.
New Browned Potatoes. Peas.
Punch.
Combination Salad.
Roquefort Cheese. Bent's Crackers.
Coffee.

RESOLUTIONS ADOPTED BY STUDENT COUNCIL.

WHEREAS, We have been deprived by death of our fellow-student, Stetson Alder, be it

Resolved, That we, the Student Body and Council of the Rose Polytechnic Institute, express our sorrow and sympathy for the bereaved family; and be it

Resolved, That these resolutions be spread upon the records of the Council and that a copy be sent to the family, and that a copy be sent to THE ROSE TECHNIC for publication.

STRECKER,
Sec. of Student Council.

RESOLUTIONS OF THE FRESHMAN CLASS.

WHEREAS, We have been deprived by death of our friend and classmate, Stetson Richard Alder; and,

WHEREAS, We feel deeply his loss; therefore be it

Resolved, That the class of Nineteen Hundred and Eight do take this means of expressing our feeling and of extending our heart-felt sympathy to the bereaved family. Be it further

Resolved, That a copy of these resolutions be presented to the family of our deceased classmate, and also that a copy be given to THE ROSE TECHNIC for publication.

C. B. ANDREWS.
O. L. STOCK.
C. O. HAMILTON.
Committee.

Terre Haute, Ind., May 3rd, 1905.

OBITUARY.

Stetson R. Alder, a member of the class of '08, died of pneumonia at the home of his parents in Terre Haute, on the afternoon of Tuesday, May 2nd, after an illness of but little more than a week. His death was unexpected by many of his classmates, as just before the time of his ill-

ness he had been actively engaged in track work, and was seemingly in the best of health. He was twenty years of age, an excellent student, and took great interest in basket-ball and running; he was a member of the city Y. M. C. A. and an active worker in the Baptist church. Quiet and unassuming, he had, during the year of work at the Institute, won a place in the hearts of those who were previously unacquainted with him, and increased the friendship of those who already knew him. His many friends, among whom all his classmates are numbered, will miss him, and the bright prospects which were his here have been exchanged for others which we know by faith, but the end is not yet, for he "is not dead, but sleepeth."

C. B. A.

PURDUE 5, ROSE 3.

THE only reason for Purdue's not returning to Lafayette without a run, can be found in the Rose error column.

Daily struck out twelve men, and Purdue got only three scattered hits, and yet the score stands five to three. If there had been only errors the score might have been different, but two or three rank misplays in fielding and base-running, and the game was lost.

By innings the game was as follows:

1. Gaetje went out on a grounder to Freudenreich. Keefe and Miles struck out. No runs.

Reed hit safely to left, but was caught out trying to steal second. Stoddard reached first on Palmer's error, and second on Cook's. Miner was out on a fly to Gaetje. Dailey then brought him in on a three-bagger. Friday was out on a hot one to Wilson. One run.

2. Palmer reached first on Mooney's error. Cook drew a base on balls, but was out on second on a grounder by Bird to Daily, and Palmer came in on an error by Bland. Bird stole second. Holter drew a base on balls, Bird reaching third on Flint out at first. Bird scored on a wild pitch. Wilson struck out. Two runs.

Douthett went out on a hit gotten by Cook. McBride got a base on balls. Mooney struck out. Reed was out at first. No runs.

3. Gaetje and Keefe struck out. Miles was out on a fly to Douthett. No runs.

Miner and Stoddard went out. Daily drew a two-bagger. Friday was out on a fly to right. No runs.

4. Palmer went out at first. Cook got a base on balls and Bird was hit. The side was then retired on a double play by Daily, Freudenreich and Mooney. No runs.

Douthett was out on a splendid catch of a foul fly by Cook, who ran into the grand stand, strainning his back so that he had to retire. McBride got a hit. Mooney got to first on Palmer's error. McBride scored on Bland's hit. Reed was out on a fly to third. Miner was out at first. One run.

5. Flint, Wilson, Gaetje went out in one, two, three order. No runs.

Stoddard and Daily were out on flies. Friday got a base on balls, but Douthett struck out. No runs.

6. Keefe and Miles struck out. Palmer got a two-bagger, but Witt retired the side. No runs.

McBride got a base on balls, stole second and went to third on Miles error of Mooney's grounder. Mooney was caught out at second, and McBride was out in endeavoring to steal home. Bland was out at first. No runs.

7. Bird went out at first. Flint struck out after Holter had reached first on an error, Wilson reached first, and Holter scored. Gaetje and and Keefe reached first on errors but Keefe was caught at second. One run.

Reed and Miner were out. Stoddard drew a base on balls, reached second on Miles' error and scored on Daily's hit. Daily went to second on the right fielder's error, but was caught at third. One run.

8. Miles struck out. Palmer reached first on Stoddard's error, and went to second on Reed's

bad throw, stole third and scored on Witt's hit. Witt went to second on Freudenreich's miss of Bird's grounder, and scored on a wild pitch. Holter struck out. Flint got a base on balls, Wilson struck out. Two runs.

Freudenreich, Douthett and McBride went out in one, two, three order. No runs.

9. Gaetje, Keefe and Miles went out in order. No runs.

Mooney went out to left. Bland hit and stole second. Reed was out on a fly to center. Miner was hit with the ball, and Stoddard ended with a grounder to Wilson. No runs.

The summary was as follows:

ROSE.

	A.B.	R.	H.	P.O.	S.H.	A.	E.
Reed, c.,	5	0	1	1	0	0	0
Miner, c. f.,	4	0	0	0	0	0	0
Stoddard, s. s.,	4	2	0	0	0	2	1
Daily, p.,	4	0	3	0	0	4	0
Freudenreich, 2,	3	0	0	3	0	2	1
Douthett, r. f.,	4	0	0	1	0	0	0
McBride, l. f.,,	2	1	1	0	0	0	0
Mooney, 1,	3	0	0	10	1	0	2
Bland, 3,	4	0	2	1	0	2	2
	—	—	—	—	—	—	—
		3	7	27	1	10	6

PURDUE.

	A.B.	R.	H.	P.O.	S.H.	A.	E.
Gaetje, c. f.,	5	0	0	3	0	0	0
Keefe, l. f.,	5	0	0	2	0	0	0
Miles, 2,	5	0	1	2	0	0	3
Palmer, 1,	4	2	1	11	0	0	2
Cook, c.,	0	0	0	2	0	2	1
Bird, r. f.,	3	1	0	2	0	—	—
Holter, 3,	3	1	0	1	0	1	1
Flint, s. s.,	3	0	0	1	0	0	0
Wilson, p.,	4	0	0	0	0	0	0
Witt, c.,	2	1	1	3	0	0	0
	—	—	—	—	—	—	—
		5	3	27	0	3	7

Earned runs—Rose 1, Purdue 0.

Three-base hits—Daily. Base on balls—Off Daily 4, off Wilson 4. Struck out—By Dailey 12, by Wilson 3. Left on bases—Rose 8, Purdue 7. Double plays—Daily to Freudenreich to Mooney. Wild pitches—Wilson 1, Daily 2. Passed balls—Cook 1, Reed 0. Hit by pitcher—Miner, Bird.

Umpire—Warrender.

Time of game—1 hour 45 minutes.

ROSE 5, JAS. MILLIKIN 1.

M. R. R., '05.

On Saturday, April 15, the team went to Decatur for the second game of the season, and came home with a well-earned victory over the J. M. U. boys in a game played under the most disagreeable weather conditions possible. It was freezing cold, and the wind blew clouds of dust across the diamond and so benumbed the players that it did not seem possible for a game to be played.

Douthett was in the box for Rose, and pitched a steady and consistent game, besides creating the only sensation of the day, when, in the fourth inning, with Daily on second and two out, he drove one to deep left for a home run.

Probably the most pleasant feature of the day outside of the victory was the courteous treatment and pleasantries the Millikin girls, lined up behind the bench furnished us, while we were at bat.

THE TALE BY INNINGS.

1st. Reed was safe on second on Wood's error of his grounder to short and went to third on McGaughey's error of Miner's drive. Miner then went to second and he and Reed both scored on Wood's error of Stoddard's hit to short. Daily hit to Wood, who threw to third and nailed "Jack." Daily was thrown out at second, and "Freudy" flew out to Wood. 2 runs.

For Millikin, Wood was out on a pop-up to Douthett, Chipps struck out and McDavid was out on first. No runs.

2nd inning. Douthett flew out to center, McBride was out on a grounder to McGaughey and Mooney was thrown out at first by House. No runs.

Moses walked, Moeller put a pop-up into Douthett's hands; House was out at first. McGaughey drew four wide ones and Simcox ended it by hitting to Mooney. No runs.

3rd inning. Bland walked, but was doubled with Reed when he hit to third. Miner struck out.

Ritz was safe on "Freudy's" error, Wood

fanned, Chipps flew out to Daily and McDavid to Mooney. No runs.

4th inning. Stoddard went out, Wood to McGaughey, Daily walked and went to second on passed ball. Freudenreich flew out to right and Douthett then got in some pretty nice stick work, driving one over Simcox's head for four sacks. McBride walked and Mooney was out on a pop fly to first. 2 runs.

Moses fouled out to Reed, Moeller was out "Freudy" to Mooney. House hit safe, stole second, but died there as McGaughey flew out to Mooney. No runs.

5th inning. Bland Walked, Reed walked. Miner hit to Ritz, who threw to third to catch Bland, but Moses dropped the ball. Stoddard hit to Moses, who threw home, cutting Bland off, and Stoddard was declared out because of Bland interfering with the catcher's throw to first. Daily went out Wood to McGaughey. No runs.

Simcox flew out to Dailey, Ritz drove a hot one into Douthett's hands and Wood fanned. No runs.

6th inning. Freudenreich, Douthett and McBride were out in one, two, three order. No runs.

Chipps was safe on Stoddard's error and stole second. McDavid fanned, Moses hit safe to center, scoring Chipps; Moeller fanned and House flew out to Miner. One run.

7th inning. Mooney was out at first. Bland walked for the third time. Reed hit to Moses, who threw Bland out at second. Miner flew out to House. No runs.

McGaughey was out Douthett to Mooney. Simcox flew out to Bland. Ritz hit safe, and Wood fouled out to Reed. No runs.

8th inning. Stoddard, Daily and Freudenreich were out in quick succession. No runs.

Chipps hit safe, but was doubled up with McDavid, going the Stoddard to Freudenreich to Mooney route. Moses struck out. No runs.

9th inning. Douthett walked and was advanced to second on Mac's sacrifice. Mooney was safe on McGaughey's error, Douthett scorng meanwhile. Bland hit to Wood, who threw Mooney out at third. Reed ended it all for Rose by striking out. One run.

Moeller was out Douthett to Mooney, House fanned and McGaughey went out, as did Moeller, Douthett to Mooney. No runs.

J. M. U.

	A.B.	R.	H.	P.O.	A.	E.
Wood, s. s.,	4	0	0	0	2	2
Chipps, c. f.,	4	1	1	3	0	0
McDavid, r. f.,	4	0	0	1	0	0
Moses, 3,	3	0	1	2	4	1
Moeller, c.,	4	0	0	3	0	0
House, 2,	3	0	1	4	5	0
McGaughey, 1,	3	0	0	11	0	2
Simcox, l. f,	3	0	0	0	0	0
Ritz, p,	3	0	1	0	0	0
Total,		1	4	26*	11	5

*Stoddard out for Bland's interference.

ROSE.

	A.B.	R.	H.	P.O.	A.	E
Reed, c.,	4	1	0	9	0	0
Miner, c f.,	4	1	0	1	0	0
Stoddard, s. s,	3	0	0	0	2	1
Daily, 3,	3	1	0	2	0	0
Freudenreich, 2,	4	0	0	1	1	1
Douthett, p.,	3	2	1	3	5	0
McBride, r. f.,	2	0	0	0	0	0
Mooney, 1,	4	0	0	10	1	0
Bland, l. f.,	1	0	0	1	9	2
Total,		5	1	27	9	2

Earned runs—Rose 1.
Home run—Douthett.
Struck out—By Douthett 6, Ritz 1, Stocks 1.
Double plays—Rose 1, J. M. U. 1.
Stolen bases—J. M. U. 5, Rose 3.
Left on bases—J. M. U. 5, Rose 5.
Umpire—Thornton.

WABASH 1, ROSE 0.

Two years ago exactly the same score was sent back from Wabash, and it seems rather hard that we should lose such a game again.

Daily pitched a better game than Boulton, but Rose had 8 errors to 4 for Wabash. Three errors lost the game in the sixth, when Wabash scored her only run. Only one other man reached third the entire game, while Rose failed to get past second.

In the first inning Reed struck out, then Miner, and Stoddard went out at first. No runs.

Thornell was out; Davies struck out; Coen reached first on Douthett's error. Boulton was out to Stoddard. No runs.

2. Daily, Freudenreich, Douthett went out one, two, three. No runs.

Harp hit, Diddel reached first. Hubbart and Myers were out on flies to McBride; Valenti was out, Daily to Mooney. No runs.

3. McBride was out. Mooney reached second on errors, but Bland and Reed were both out. No runs.

Thornell and Davies were out. Coen hit safely, but Boulton struck out. No runs.

4. Miner reached first on Harp's error, but the next three men were out. No runs.

Harp, Diddel, Hubbart out in order. No runs.

5. Douthett hit, but was caught attempting to steal second. McBride and Mooney went out in succession. No runs.

Myers, Valenti and Thornell went out in order. No runs.

6. Bland drew a base on balls, but on Reed's grounder to Boulton, was caught at second. Miner and Stoddard struck out. No runs.

Boulton was out at first. Harp reached first on Freudenreich's error, second on Mooney's error. Diddel reached first on Stoddard's error, Harp reached third, and scored on a wild pitch. Hubbart and Myers were out. One run.

7. Daily, Freudenreich, and Douthett out in order. No runs.

Valenti, Thornell out. Davies got a pass, but was out on a grounder to Stoddard. No runs.

8. McBride, Mooney and Bland went out in one, two, three order. No runs.

Boulton hit, and reached second on a wild pitch. Harp struck out, and Diddel and Hub bart went out at first.

9. Reed and Miner were out. Stoddard reached second on errors. Daily ended with a grounder to Hubbart.

Score and summary :

WABASH.

	A.B.	R.	H.	P.O.	A.	E.
Thornell, c. f.,	4	0	0	1	0	0
Davies, 3,	3	0	0	2	0	0
Coen, c.,	3	0	0	4	1	0
Boulton, p.,	4	0	1	1	7	0
Harp, 1,	4	1	2	11	0	2
Diddel, s. s.,	4	0	0	0	1	1
Hubbart, 2,	4	0	0	5	3	1
Myers, l. f.,	3	0	0	2	0	0
Valenti, r. f.,	3	0	0	1	0	0
Total,		1	3	27	12	4

ROSE.

	A.B.	R.	H.	P.O.	A.	E.
Reed, c.,	4	0	0	4	0	1
Miner, c. f.,	4	0	0	0	0	0
Stoddard, s s.,	3	0	0	3	2	2
Daily, p.,	4	0	0	4	1	1
Freudenreich, 2,	3	0	0	0	0	1
Douthett, 3,	3	0	1	1	6	2
McBride, r. f.,	3	0	0	2	0	0
Mooney, 1,	3	0	0	13	0	1
Bland, l. f.,	2	0	0	0	0	0
Total,		0	1	27	9	8

First base on balls—Off Daily 1, off Boulton 1.
Struck out—By Daily 4, by Boulton 3.
Left on bases—Wabash 7, Rose 4.
Double plays—Daily to Mooney.
Wild pitches—Daily 2.
Passed balls—Reed 1.
First base on errors—Rose 2, Wabash 5.
Umpire—Whittington.
Time of game—1:25.

CULVER 2, ROSE 0.

Anybody who could see the grounds at Culver would not need to ask why the score stands as it does. The diamond slanted two ways and so resembled a sponge that clean infielding was almost impossible.

Rose had men on base nearly every inning but cauld not bring them in.

Daily and Moore each had nine strike outs to his credit, while Daily gave one base on balls to Moore's two.

The score by innings follows :

1. Campbell, Warden and Loucks went out in order. No runs.

Reed reached first on Loucks' error, Bland struck out. Reed went to second on Stoddard's out at first and was caught at home in trying to get in on Daily's hit to right. No runs.

2. McKelvey reached first on Stoddard's error, but was caught at second. Richardson got a hit, went to second on Lewis's error, and scored on Miner's error of Taylor's fly. Taylor was caught at third by Stoddard, and Gruet struck out. One run.

Lewis out at first. Douthett hit and stole second. McBride reached first. Then after Mooney was safe, and the bases full, Miner knocked one to Warden, who caught Mooney at

second and completed the double at first. No runs.

3. Sheller, Moore and Compbell went out in one, two, three order. No runs.

Reed drew a three-bagger, but Bland, Stoddard and Daily went out without his crossing the plate. No runs.

4. Warden, Loucks, McKelvey out in order. No runs.

Lewis struck out. Douthett reached first on an error, but after reaching third, McBride and Mooney were out at first. No runs.

5. Richardson, Taylor, Gruet out in order. No runs.

Miner struck out, Reed out on foul, Bland hit, and stole second, Stoddard knocked a grounder to Moore who caught him at first. No runs.

6. Sheller hit; went to second on Mooney's error. Moore was out to Mooney. Campbell was caught out by Miner. Sheller went home on Lewis's overthrow of Warden's grounder. Loucks was out, Daily to Mooney. One run.

Daily, Lewis, Douthett out in order. No runs.

7. McKelvey struck out. Richardson got a base on balls. Taylor hit safely, but Gruet struck out, and Sheller out on a fly to Daily. No runs.

McBride, Mooney and Miner out in order. No runs.

8. Moore struck out; and Campbell went to second on Warden's sacrifice. Loucks struck out. No runs.

Reed drew a base on balls. Bland the same. Stoddard was out for bunting foul on third strike. Daily hit one to Moore, and was caught at first. Lewis ended with a fly to center. No runs.

9. McKelvey, Richardson and Taylor out in order. No runs.

Douthett hit safely but McBride, Mooney and Miner went out in order. No runs.

Score and Summary:

CULVER.

	A.B.	R.	H.	P.O.	A.	E.
Campbell, l. f.,	4	0	1	0	0	0
Warden, 2,	3	0	1	1	1	0
Loucks, c. f.,	4	0	0	2	0	1
McKelvey, c,	4	0	0	9	0	0
Richardson, s s,	3	1	1	0	0	0
Taylor, 3,	3	0	1	2	1	0
Gruet, r. f.,	3	0	0	1	0	0
Sheller, 1,	3	1	1	9	0	1
Moore, p.,	3	0	0	1	5	1
Total,		2	5	25*	7	3

*Bland and Stoddard out for bunting third strike foul.

ROSE.

	A.B.	R.	H.	P.O.	A.	E.
Reed, c.,	3	0	1	10	3	0
Bland, l. f.,	3	0	1	1	0	0
Stoddard, s. s.	4	0	0	2	1	1
Daily, p,	4	0	1	1	5	0
Lewis, 2,	4	0	0	1	0	2
Douthett, 3,	4	0	2	2	1	1
McBride, r. f.,	4	0	0	0	0	0
Mooney, 1,	3	0	0	7	0	1
Miner, c. f.,	4	0	0	3	0	1
Total,		0	5	27	10	6

Three-base hits—Reed.
First base on balls—Off Daily 1, off Moore 2.
Struck out—By Daily 9, by Moore 9.
Left on bases—Rose 9, Culver 4.
Double plays—Warden to Sheller.
Hit by pitcher—Mooney, Taylor.
Umpire—Greiner.
Time of game—1 hour 30 minutes.

INDIANA 6, ROSE 2.

M. R. R. '05.

Rose met another defeat at the hands of Indiana on Saturday, April 29th. Rose started out well in the first, scoring both runs on two clean hits, an error and a bunt, but was unable to score afterward, although men were on base nearly every inning.

In liana did not have a look in until the fifth when they got together and scored four runs on four hits and an error. Again in the seventh Indiana got two more on three hits and a sacrifice. This ended the run getting for this game.

Douthett for Rose pitched a good game with the exception of the fifth and seventh innings and was given good support.

Dunlap for Indiana pitched a consistent game throughout, having six strike outs to his credit, while Douthett had nine.

The following is the score by innings:

1st inning. Reed led off with a hit to right and Bland followed with one over second. Both were advanced on Douthett's sacrifice. Daily followed with a pretty bunt and Reed crossed the rubber. Freudenreich then hit to Bradbury who fumbled the ball and Bland scored. Stoddard struck out.

E. Boyle flew out to Bland, Bradbury and Robinson fanned.

2nd inning. McBride fanned, Mooney flew

out to left and Miner put a pop-up into Dunlap's hands.

Hare was out, Stoddard to Mooney. Kempf struck out and McFerrin walked. Reasoner hit to Stoddard who over-threw first. McFerrin tried to score but was thrown out at third on account of a ground rule, that a runner could advance but one base on an over-throw.

3rd inning. Reed went out Dunlap to Reasoner. Bland struck out and Douthett followed with a long fly to center which Hare captured after a hard run.

Rau, Dunlap and Boyle were out in succession on easy infield chances.

4th inning. Daily got to first by being hit, Freudenreich struck out. Stoddard went out Boyle to Reasoner. Daily going to second on the play. McBride got a base on balls and Mooney ended the inning by a grounder to Robinson.

Bradbury was out on a grounder to Mooney. Robinson fanned. Hare hit safely to right, and Kempf fanned.

5th inning. Miner led off with a clean hit over short and went to second on Reed's bunt and to third on Bland's sacrifice. Douthett again planted a long fly into Hare's hands.

McFerrin struck out, but Reasoner hit safely to right. Rau was safe on Douthett's error. Reasoner going to third on the play and scoring on Dunlap's hit to left. Boyle scored Rau and Dunlap on a two-bagger between Bland and Miner. Bradbury then hit to left scoring Boyle but was thrown out at second trying to stretch it into a two-bagger. Robinson went out Douthett to Mooney.

6th inning. Daily got to second on Dunlap's error and went to third on Freudenreich's long fly to right. Stoddard attempted to bunt but Robinson came in hard, caught the ball on the fly and doubled Daily on third.

Hare drove a liner into Bland's hands and Kempf and McFerrin were out on infield chances.

7th inning. McBride fanned. Mooney got a base on balls but was thrown out at second. Miner followed with a pop-up which McFerrin captured.

Reasoner led off with a hit and went to second on Rau's sacrifice and to third on Dunlap's safe to left. Boyle hit to Daily who threw home cutting Reasoner off from scoring. Reasoner was injured in attempting to slide under Reed and was relieved by Shelton. Bradbury then hit down the left foul line scoring Dunlap and Boyle. Robinson ended the inning by striking out.

8th inning. Reed was out McFerrin to Shelton, and Bland struck out. Douthett and Daily both secured hits, but did not score, as Freudenreich was out, Dunlap to Shelton.

Hare and Kempf were both out on strikes and Mc Ferrin hit a pop-up to Freudenreich.

9th inning. Stoddard struck out. McBride was robbed of a hit, being called out at first after he had safely crossed the bag. Mooney ended it all on a grounder to Dunlap.

ROSE.

	A.B.	R.	H.	P.O..	A.	E.
Reed, c.,	3	1	1	10	0	0
Bland, l. f.,	3	1	1	2	1	0
Douthett, p.,	3	0	1	1	5	1
Daily, 3,	2	0	1	1	2	0
Freudenreich, 2,	4	0	0	3	0	0
Stoddard, s. s.,	3	0	0	0	1	1
McBride, r. f.,	3	0	0	0	0	0
Mooney, 1,	3	0	0	7	2	0
Miner, c. f.,	3	0	1	0	0	0
Total,		2	5	24	11	2

INDIANA.

	A.B.	R.	H.	P.O.	A.	E.
Boyle, 2	4	2	1	1	3	0
Bradbury, 3,	4	0	2	1	0	0
Robinson, s. s.,	4	0	0	1	2	1
Hare, c. f.,	4	0	1	2	0	0
Kempf, r. f.,	4	0	0	1	0	0
Mc Ferrin, c.,	3	0	0	8	4	0
Reasoner, 1,	3	1	2	7	0	0
Rau, l. f.,	2	1	0	1	0	0
Dunlap, p.,	3	2	2	1	3	1
Shelton, 1,	0	0	0	4	0	0
Total,		6	8	27	12	2

	1	2	3	4	5	6	7	8	9	
Rose,	2	0	0	0	0	0	0	0		0—2
Indiana,	0	0	0	0	4	0	2	0		*—6

Two-base hits—Boyle, Bradbury.
Earned runs—Rose 2, Indiana 3.
Base on balls—Off Douthett 1, off Dunlap 2.
Struck out—By Dunlap 7, by Douthett 9.
Double plays—Robinson and Bradbury.
Left on bases—Indiana 3, Rose 4
Hit by pitcher—Daily.
Umpire—Jimmy Boyle, of Indiana.

ROSE 13, BUTLER 3.

The score shows that the game was really a farce, and everybody enjoyed it thoroughly.

Daily struck out thirteen men, while Davis could fan only two. Douthett played a good game at third, accepting four chances without an error, and has a put-out to his credit.

Rose started the fun in the first.

Reed walked and reached second on Murray's fumble of Miner's grounder. Douthett reached first on Davis' error, and the bases were full. Then Daily drew a pass, and forced Reed across the plate. Then Freudenreich struck out; Stoddard and McBride were out on in-field flies. One run.

In the second, Mooney was safe on Barnett's error of his fly. Thurman made a hit, and both men reached the bases safely. Reed reached first on Davis's error. Miner struck out. Mooney came in on Douthett's long fly to right. Thurman came in on Murray's error, and Reed scored on a wild pitch. Stoddard ended the inning with a liner to third. Three runs.

In the third, McBride went out on a foul pop-up. Mooney drew a base on balls, stole second. Thurman flied out to third. Reed got a hit, Mooney scoring. Reed went to third on Miner's hit, and came in on an error by Davis Douthett ended the inning by a grounder to Wininas, who caught Miner at second. Two runs.

Butler's first score came in the fourth. Bohnstadt went out at first. Wininas was hit by a pitched ball and stole second. Murray went out to Stoddard. Then Conner knocked a two-bagger, scoring Wininas. Cook stopped the scoring by striking out. One run.

Both sides scored in the sixth. Bohnstadt struck out. Wininas got a hit, and went to second on Freudenreich's error, Murray reaching first. Conner and Forsith each hit safely, bringing Wininas and Murray in. Cook and Barnett went out, retiring the side. Two runs.

Miner got a hit, and went to second on Douthett's sacrifice. Riddell caught Daily's fly. Miner scored on Freudenreich's hit. Stoddard ended it with a fly to third. One run.

Then the balloon rose.

McBride and Mooney hit safely. Thurman went out to first. Reed reached first on Wininas' error, McBride scoring. Miner hit safely, and Mooney scored. Daily hit safely and Reed scored. Freudenreich knocked a long fly that Barnett dropped, and Miner and Daily crossed the plate. Freudenreich scored after Stoddard had drawn a base on balls. McBride sent a long fly to Barnett, who stopped the slaughter. Six runs.

Neither side scored in the remaining two innings. Summary :

BUTLER.

	A.B.	R.	H.	P.O.	A.	E.
Riddell, 1,	3	0	0	10	0	0
Bohnstadt, l. f.,	4	0	0	0	0	0
Wininas, s. s.,	3	2	1	5	1	1
Murray, 2,	4	1	0	1	1	2
Conner, c.,	4	0	2	3	0	0
Forsith, 3,	2	0	1	2	0	0
Cook, r. f.,	4	0	0	1	0	0
Barnett, c. f.,	5	0	0	2	0	2
Davis, p.,	4	0	0	0	4	3
Total,		3	4	24	6	8

Douthett pitched for Daily after fifth inning.

ROSE.

	A.B.	R.	H.	P.O.	A.	E.
Reed, c.,	4	4	1	14	2	0
Miner, c. f.,	5	2	3	1	0	0
Douthett, 3,	3	0	0	1	4	0
Daily p,	3	1	2	1	0	0
Freudenreich, s. s.,	4	1	1	2	0	1
Stoddard, 2,	4	0	0	3	1	0
McBride, l. f.,	5	1	1	0	0	1
Mooney, 1,	4	3	1	5	0	0
Thurman, r. f.,	4	1	0	0	0	0
Total,		13	9	27	7	2

Earned runs—Butler 1, Rose 4.
Two-base hits—Connor.
First base on balls—Off Daily 2, off Davis 6.
Struck out—By Daily 13, by Davis 2.
Left on bases –Rose 10, Butler 6.
Wild pitch—Davis.
First base on errors—Butler 1, Rose 6.
Umpire—Ebards.
Time—1 hour 30 minutes.

Doc. W.—"Mr. Moore, how do you tell the combining weights of oxygen and hydrogen?"

Moore—"Why, you take water and electrocute it, and then weigh the gases."

STOCK'S SOLILOQUY.

"Which way do you read this vernier? Here goes: heads I win, tails you lose; heads has it; to the left."

Boase, '08—"What's the meaning of 'abuttment,' Nourse?"

Nourse—"'A buttment,' why you ought to know what that is."

One of the more irrepressible Freshmen, feeling his bosom thrill with the awakening into new life of old Mother Earth, in obedience to the poetic (?) instinct which is more or less characteristic of youth, evolved the following rhymes, the publication of which may be sufficient punishment, as it will be seen that he has promised to sin no more:

SPRING SONG.

TUNE—*The Bowery.*

We went one day to the paper mill
And go there again we never will.
We knew what it was when it first went in,
But what was it like when it came out agin?
We used to chew spit-balls to shoot through a quill,
But we'll never do that any more.

CHORUS:

Come along, then; come along, then;
We're all going out to the rolling mill;
Bum along, men; bum along, men,
For we'll never go there any more.

The bottle works sure have a charm for Dad,
Who was always a totally abstinent lad;
We saw how they blew when they blew in the glass,
They blew even more than the Sophomore class;
But we "lifted" so much and we acted so bad
That we'll never go there any more.

CHORUS:

The rolling mill isn't a scene of bliss,
With iron volcanoes that splutter and hiss.
From the soot and the heat that about it dwell,
You'd think they were running a small sized hell,
But a Poly boy always gets plenty of this,
So we'll never go there any more.

CHORUS:

RECITATIVE.

A German Professor, as I am told,
Went alphabetically down the roll,
And whenever he called on his men to recite,
They seemed to always get it right.
But, alas, what a happening happened one day
When he, somehow or other, started out the wrong way?
He must have called on ten or more,
But they'd been up just the day before,
And from the way they resisted one would scarcely have guessed
That they were of those who *Deutsch sprechened* the best.
Just then the Professor began to grow wise
And smiled out a smole from his goo-goo eyes,
Said, "The A to Z system hereafter will cease,
And if so, how many marks do you think decrease?
I give you fair warning, I shall now change the way,
And hereafter will call on you from Z to A."

RAGTIME.

TUNE—*Alexander.*

Look heah, boss mechanic, we was only foolin'
Don't yo' know that outin's have to come with schoolin'?

'Tain't no use a-givin' us extra work to do,
Honest, now, ole fellah, we had all too much before,
When we've worked off one condition, we have got two more.
Won't you come down easy on the final exams?
When vacation comes we'll give nine 'rahs fo' you,
Give you a ticket nex' time to the Modulus dance,
If you'll only give us half a chance.

CHO. Can't yo' see the D's an' Es am fastly fallin' thick an' num'rous?
Don' yo' know that wo'k in springtime's gallin'?
Can't you humour us?
We'll treat the Freshmen nex' yeah jus' as sweet as honey;
We'll laugh at all the jokes yo' make an' say they're funny;
Say; boss, won' yo' let us try the job again?

ALLEGRO.

There once was a man who would never say "please,"
But down on his table he'd sit at his ease
And speak to his class-room in words such as these:
"If you fellows find that really you must sneeze,
You must sneeze as a civilized man should,
Or else you must prove that you always did wheeze
As broken-down hydraulic ram would."

A quiz for his class was to him only play,
Then they could recite for the rest of the day;
This game would work well when the fellows would stay,
But the beautiful springtime allured them away.

* * * * * *

And they swore to the dickens that Mac was all right;
"He's a bluffer for sure, but that's only his way,
He gave a square deal and he treated us white."

L'ENVOI.

Whene'er the muse inspires me
My room-mate ups and fires me.
Alas, 'mongst all the people that I've met,
It seems as though not one admires me.

Of course, my verse is not like Tennyson,
Or Shakespeare, Browning, or most anyone,
But should I not still find some trace of fame?
For sure I am as good as Atherton.

The turquoise skies, the budding trees of Spring,
The rippling, purling Wabash bids me sing;
But ah, how oft that room-mate doth abuse me;
At my devoted head his books doth fling!

Farewell, farewell, sweet realm of Poetry!
I nevermore shall take a go at thee!
Since critics crit and knockers knock,
And friends cry quit, may so it be.

The following conversation was overheard on our telegraph line the other day:

"Did you hear that noise this morning?"

"What time?"

"About 4 o'clock."

"What kind of a noise?"

"Crash."

"No. What was it?"

"Day-break."

Addie (on locomotive test)—"Are we this side of Brazil, or the other side?"

Wicky—"Mr. Lawton, you may translate the next paragraph."

Lawton (absent-mindedly)—"I pass."

What could he have been thinking of?

Junior (translating Spanish)—"On our hands we have toes, just as on our feet."

We quote the following bit of startling news from an exchange:

"A young theologian named Fiddle refused to accept his degree. "For," he said, "it's enough to be Fiddle, without being, Fiddle D. D.'"

Mac. (in Trig.)—"Hand in your problems."

Beckett, '08—"I have mine worked, but didn't have time to copy them."

Lindsley, '08 (to himself)—"I have mine copied, but didn't have time to work them."

A couple of Seniors were talking about a water-bath being a non-inductive load, when a Soph asked the meaning of the subject of the conversation.

Jenckes—"It means that there is no inducement to take a water-bath."

AT THE BOARDING-HOUSE.

Barker—"Bland will not be here for dinner today."

Landlady—"I wish I had known that sooner. I would have cut up only one chicken instead of two."

Dr. White—"Moore, please explain the Atomic Theory."

Moore—"Why, you electrocute the water."

Freshman—"How is it that there is no hot water in my room?"

Landlady—"I can't let it run upstairs, it might get overheated."

Turk (after losing 10 cents on the ball game)—"The only thing that I ever bet on that didn't go up in the air was—an air-ship."

Lee—"I wish the year was just beginning."

Lawton—"My! you must have a bad case. Who is the girl?"

Why don't some of the Freshmen come out for the track team? At Marshall they proved the fact that the class is full of sprinters. Indeed, Budge was such a plucky runner that he led the crowd, in spite of his sprained ankle.

Hath (drawing a heart-shaped figure on the board)—"You see, boys, there is sentiment even in mathematics."

QUEER TASTE.

'Arry requested Mr. Bennett for some books, among them being, "Three Buckets of Blood, or Across the Ocean on a Shingle;" "The Molder's Mystery, or Who Put the Brush in the Sprinkling Can?"

THOUGHT HE WAS A NORMALITE.

Bland happened to drop into a church on Easter Sunday. The preacher noticed the green-looking stranger on the back row and said, "I am glad to see with us this morning one of the students who has come for the Spring term."

EXCHANGES

In a dual meet between Oxford and Cambridge two Rhodes scholarship men from the United States won points. W. E. Shutt, formerly of Cornell, won second in the three-mile run, and P. M. Young, formerly of South Dakota, tied with two others for first place in the high jump.

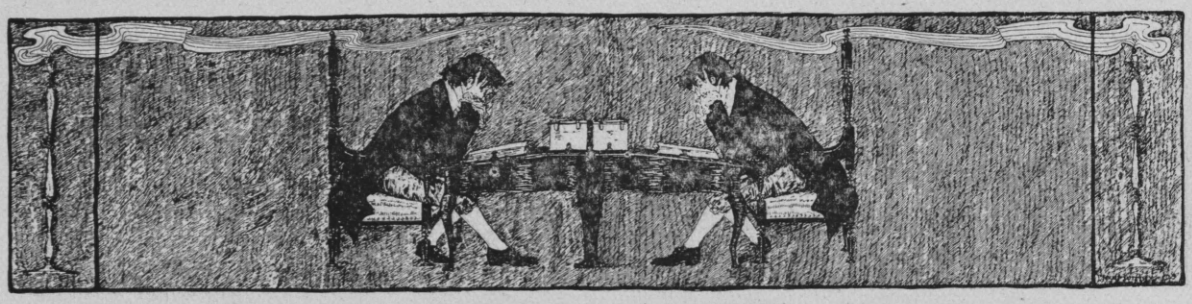
Captain Bud, of Michigan, base-ball team, has resigned and will play with the Buffalo team. —[*DePauw.*

Johns Hopkins University defeated Pennsylvania at LaCrosse, by a score of 9–0.

Yale and Pennsylvania have broken off athletic relations in aquatic contests.

Garrels, of Michigan, broke the world's record for throwing the discus by nearly four feet. The distance was 131 feet 4 inches, and on a second trial immediately after he threw it 127 feet. —[*Exponent.*

Chicago lost in a ball game to Northwestern University by a score of 6–5.



REVIEWS

THE Principal Professional Papers of Dr. J. A. Waddell, Civil Engineer. Edited by John Lyle Harrington, Civil Engineer. Published by Virgil H. Hemes, New York City, N. Y. Cloth binding. Pages 991. Price $5.00.

The variety of subjects treated by the author in this publication is best shown by the title of the papers, which are as follows:

Notes on Railroad Drainage.

Notes on Railroading.

An Address Delivered Before the Members of the Kogaku Kyokai.

Civil Engineering Education.

Some Notes Upon Civil Engineering, With Special Application to Japan.

A Letter Relating to Civil Engineering Education.

The Advisability of Instructing Engineering Students in the History of the Engineering Profession.

General Specifications for Highway Bridges of Iron and Steel.

Some Disputed Points in Railway Bridge Designing.

The Compromise Standard System of Live Loads for Railway Bridges and the Equivalents for Same.

Discussion by J. A. L. Waddell of Mr. E. Herbert Stone's Paper, Entitled "The Determination of the Safe Working Stresses for Railway Bridges of Wrought Iron and Steel."

Address to the Graduating Class of the School of Engineering of the University of Kansas.

The Halsted Street Lift Bridge; Elevated Rail roads; The Bridge Engineer.

Foundations for Important Buildings in the City of Mexico.

Address to the Graduating Class of the Rose Polytechnic Institute.

Address to the Engineering Students of the Missouri State University.

Specifications.

The Kansas City Floor-Line Bridge Repairs.

Higher Education for Civil Engineers.

The Relations of Civil Engineering to the Other Branches of Science.

In the limited space available it will be possible to point out only a few of the features of the book of value or interest to one class of readers, namely, the undergraduate in civil engineering.

In the various addresses before graduating classes he will receive much good advice, with now and then some that may be questioned. For example, the omission of language study other than English in undergraduate courses. In the paper on Civil Engineering Education he will find that a number of the subjects in his own course of study which he is inclined to slight as being of little value to a civil engineer, are considered of much value by the author, his opinion being founded upon experience.

The papers upon strictly engineering subjects are invaluable for reference, as they cover such a wide extent of practice and contain the opinions of eminent engineers upon the ideas advanced by the author.

The student will have considerable confidence in the author's opinions when he sees that many of the opinions advanced in the earlier papers adversely criticised, are now considered the best practice.

Incidentally, he will derive considerable benefit in reading the excellent English employed throughout.

Any undergraduate who is at all interested in the profession he expects to follow should by all means read this book and own a copy if possible.

The edition deserves nothing but praise for the manner in which the papers have been presented with introductory remarks preceding the papers and the comments which follow.

The typography and binding are good—only two or three cuts have suffered too much reduction. MALVERD A. HOWE.

THE fuel tests conducted at St. Louis during the World's Fair by the U. S. Geological Survey will be continued on a more elaborate scale, the last Congress having appropriated $202,000 for the purpose. The former plant in World's Fair Grounds is now being enlarged and improved, and the tests will cover all applications of coal for fuel purposes.—[*Electrical World and Engineer.*

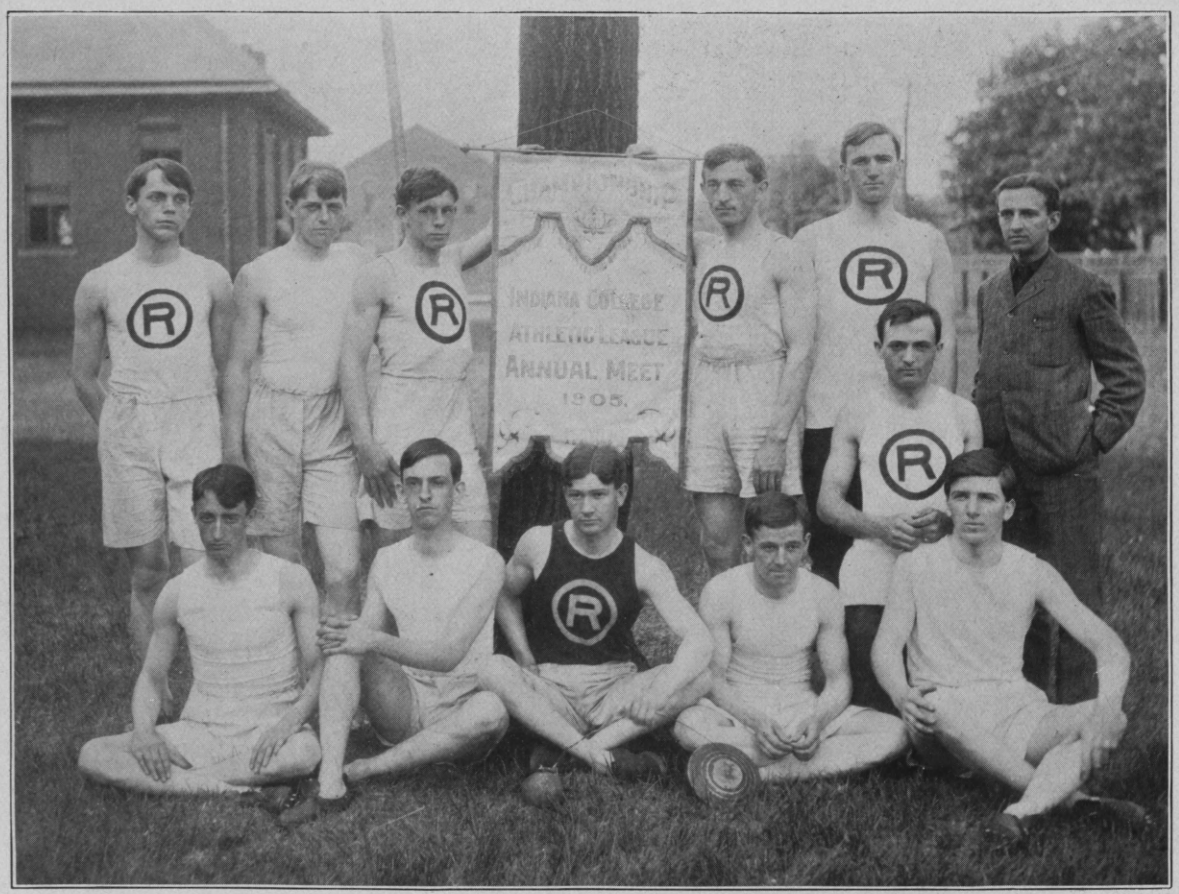
THE Swedish Government has recently had constructed in this country an electric locomotive which is to operate at a trolley voltage of 18,000 volts. The weight of the locomotive and equipment is 25 tons, all of which is carried on four 41-inch drive wheels. Two 150-h. p., 25 cycle, single-phase motors are geared one to each axle, with a gear reduction of 18 to 70, and have shown an ability to handle a 70-ton train at 40 miles per hour, without exceeding the rise of temperature for which they were designed.

AMONG the papers contained in the *Journal of the Association of Engineering Societies* for March are: Hydro-Electric Power Development and Transmission in California (illustrated); Weak Points in Long Distance Electric transmission; and Engineering and the Law.

THE finishing of the boring of the Simplon Tunnel marks the completion of one of the greatest engineering enterprises of the century, and an article in the current issue of the *Engineering Magazine* should prove of interest to those who have watched the progress of this undertaking during recent years.

THE Ontario Power Company, of Niagara Falls, has recently completed the installation of a horizontal type turbine of the largest capacity ever built. This turbine is of the inward flow, double Francis type, having two runners 78 inches in diameter, each capable of developing 5,700 h. p. It is to operate under a head of 175 feet and at a speed of 187½ revolutions per minute. This is the first of twenty to be installed for the development of 200,000 h. p., each turbine driving a 10,000 h. p. generator.

THE largest steel floating dock in the world is approaching completion at Sparrows Point, Maryland It is being built for the United States Government, and will be towed to the Philippines, 14,000 miles. It is 500 feet long over all, 100 feet wide inside and 134 feet wide outside, the side walls being 42 feet high inside and 64 feet outside. The structure contains 11,000 tons of steel and 2,000,000 rivets. When floating at its lightest it will draw 6½ feet of water, and when submerged to give a draft of 30 feet it will require a depth of 63 feet. It will lift a 16,000-ton battleship and 4,000 tons more. The dock is equipped with a complete machine shop for ordinary repairs and has also and electric plant and water distilling apparatus. Nine officers and twelve men will be provided with permanent quarters.—[*American Machinist.*



ROSE TRACK TEAM, 1905.